RECEIVED
CENTRAL FAX CENTER
APR 06 2005

MAIL STOP APPEAL BRIEF - PATENTS
PATENT
2328-053

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Appeal of	: Confirmation No. 5171
Tuqiang NI et al.	: Art Unit: 1763
Serial No.: 09/821,753	: Examiner: L. Alejandro-Mullero
Filed: March 30, 2001	:
For: PLASMA PROCESSING METHOD AND APPARATUS WITH CONTROL OF PLASMA EXCITATION POWER	

April 6, 2005

04/07/2005 BBURKER 00000005 09821753
01 FC:1401 500.00 OP

BRIEF ON APPEAL

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Further to the Notice of Appeal filed February 17, 2005, in connection with the above-identified application on appeal, herewith are three copies of Appellants' Brief on Appeal. Authorization for payment of the $500 statutory fee is attached.

To the extent necessary, Appellants hereby request any required extension of time under 37 C.F.R. §1.136 and hereby authorize the Commissioner to charge any required fees not otherwise provided for to Deposit Account No. 07-1337.

CERTIFICATION OF FACSIMILE TRANSMISSION
I HEREBY CERTIFY THAT THIS PAPER IS BEING FACSIMILE TRANSMITTED TO THE PATENT AND TRADEMARK OFFICE ON THE DATE SHOWN BELOW

Tracy A. Luke
TYPE OR PRINT NAME OF PERSON SIGNING CERTIFICATION

Tracy A Luke 4/6/05
SIGNATURE DATE

703/872-9306
FACSIMILE NUMBER

TABLE OF CONTENTS

I. Real Party in Interest

The real party in interest is Lam Research Corporation, a leading manufacturer of equipment that uses plasma for etching features on integrated circuits. The company website is http://www.lamrc.com.

II. Related Appeals and Interferences

There are no related appeals and/or interferences.

III. Status of Claims

Claims 1-6, 14, 16-18, 20-28, 30, and 31 are pending in the application. Claims 14, 16, 24, and 27 are withdrawn from consideration because, in the Examiner's opinion, they are directed to an invention that is separate and distinct from that of the remaining claims. Claims 7, 15, 19, and 29 are cancelled. Claims 1-6, 8-13, 17, 18, 20-23, 25, 26, 28, 30, and 31 are rejected. No claims are allowed.

IV. Status of Amendments

An Amendment after final rejection filed December 20, 2004, was entered. The changes presented in this Amendment are reflected in the accompanying claims appendix.

V. Summary of Claimed Subject Matter

The claimed subject matter is directed to a method of etching a workpiece in a vacuum plasma processor chamber (40) and to a memory (24) storing a computer program (page 12, line 22-page 13,

line 5) for controlling a computer (20) for controlling etching of a workpiece in such a chamber (page 13, line 19-page 14, line 18). A purpose of the invention is to provide for more precise control over the etching process. At the time the present application was filed, Appellants were aware of attempts to obtain more precise control by supplying different gases to the workpiece during processing. However, supplying different gases to the workpiece during processing has the disadvantage of slow processing times because of the time required to clear the lines and chamber of the different gases and precise control of processing the workpiece(page 3, lines 11-28).

In Appellants' method, precise control is obtained by converting a gas species into an AC-powered etchant plasma that is continuously applied to a workpiece while a feature of the workpiece is being formed. The amount of AC power supplied to the plasma during continuous etching of the workpiece to form a feature such as a rounded corner is gradually changed on a preprogrammed basis, causing a gradual transition in the shape of the workpiece (54) material being processed (page 5, lines 16-28, page 16, line 21-page 17, line 12).

Preferably, the gradual power change includes steps having power changes no greater than about several watts such that the power remains at a constant wattage for no more than about 1 second. If the wattage remains constant for more than about 1 second, the desired feature control is not obtained (page 6, lines 3-10, page 13, lines 6-18). The gradual power change occurs while

gas species, chamber pressure, and gas species flow rate remain constant (page 16, line 21-page 17, line 7) to avoid the problems associated with altering parameters in the chamber during processing (page 3, lines 11-28).

Power can be applied to the plasma by an amplifier (132) that drives an electrode (56) for supplying an electric field to the chamber and/or by an amplifier (102) that drives a coil (48) for supplying an electromagnetic field to the chamber (40) (page 13, lines 6-18, page 17, lines 9-10). In one particular use, the continuous application of plasma to the workpiece is such that the material is shaped to have a rounded corner (216, Fig. 6) which is achieved in response to changes in the ionized plasma etchant resulting from the gradual power change, while the chamber pressure etchant flow rate and the etchants are unchanged (page 16, line 21-page 17, line 7, page 17, lines 14-15). The etching which occurs in response to changes in the ionized plasma resulting from the gradual power change and the continuous application of etching plasma to the workpiece can form a trench wall including the rounded corner (page 6, lines 1-2, page 17, lines 12-15).

VI. Grounds of Rejection to be Reviewed on Appeal

Claims 1-6, 8-13, 17, 18, 20-23, 25, 26, 28, 30, and 31 are rejected under 35 U.S.C. §103(a) as being unpatentable over Bhardwaj et al. (U.S. 6,051,503) in view of Howald et al. (WO 00/58992). The Examiner relies on Howald to disclose ancillary features, relating to the use of computers and the application of

power to a coil or electrode, Appellants agree are obvious. Hence, the issues to be resolved are whether Bhardwaj et al. discloses the processing features of claims 1, 2, 8-13, 17, 18, 20-28, 30, and 31. Because, the Examiner advances no arguments or rationale with regard to inherency or obviousness concerning Bhardwaj et al., no consideration of these factors is necessary. An important ancillary issue is whether Bhardwaj et al. causes a rounding feature to be formed solely by etching. This issue was first raised by the Examiner in the January 3, 2005, Advisory Action. Bhardwaj et al., on its face, indicates all desired features are attained by alternately depositing material and etching. Bhardwaj et al. does not produce a feature by continuously applying an AC etchant plasma to a workpiece while a feature is being formed, as all claims on appeal require.

VII. Argument

As discussed in column 1, lines 41-50, Bhardwaj et al. is concerned with a method of etching a trench in a semiconductor substrate in a plasma reactor chamber by alternate (1) reactive ion etching and (2) depositing a passivation layer by chemical vapor deposition. One or more of the following parameters is varied: gas flow rates, chamber pressure, plasma power, substrate bias etch rate, deposition rate, cycle time and etching/deposition ratio. The variations may be periodic, the etching and deposition states may overlap and the etching and deposition gases may be mixed.

The specific Bhardwaj et al. embodiments include alternate (1) reactive ion etching and (2) depositing of a passivation layer by chemical vapor deposition; see the Abstract, line 4. Figures 6(a), 6(b), 6(c), 6(d) and column 5, line 50 indicate there is alternate depositing and etching of material while coil power is continuous and unchanging; Figures 6(a), 6(b), 6(c), 6(e) and column 5, line 61 indicate there is alternate depositing and etching while coil power is switched; and Figures 6(a), 6(b), 6(c), 6(f) 6(g), 6(h) and 6(i) and column 5, line 57, through column 6, line 7, indicate there is alternate depositing and etching while bias power is varied or switched between on and off states; bias power is the power applied by DC source 17 to substrate support electrode 12.

The first three waveforms of Figure 7 that correspond to the waveforms of Figures 6(a), 6(b) and 6(c) (column 3, line 6) also indicate alternate deposition and etching can occur under different coil power and bias power scenarios. Figures 9(i) and 9(ii) include ramped waveforms indicative of pressure, gas flow rates, coil power and RF bias in combination with alternate deposition and etching steps; see column 6, lines 43-67 and column 9, line 40-column 10, line 3, particularly column 9, lines 43, 46, 47, 53, 54 that says the cycle changes from deposition to etch. The ramps of Figures 9(ii) are respectively of (1) cycle time and (2) cycle time and amplitude. Bhardwaj et al. states that by using the foregoing alternate procedures, trenches were formed in

semiconductor substrates, as illustrated by the scanning electron micrographs of Figures 12-14, 17 and 18; see column 3, lines 16-20 and 24-28.

The ramping of parameters in Bhardwaj et al. was performed to obviate problems with the prior art techniques associated with alternating etching and deposition, as set forth, for example, in column 4, lines 1-12. This portion of Bhardwaj et al., relied upon by the Examiner in the Advisory Action, discusses the adverse undercutting effects schematically illustrated in Figures 2 and 3 of the Bhardwaj et al. patent and shown by the scanning electron micrographs (SEMs) of Figures 10 and 11. Column 4, lines 3-11, states:

> The process described in that document (the prior art to Bhardwaj et al.) uses sequential and discrete etch and deposition steps so that after the first etched step the sidewalls are <u>undercut as shown at 20</u> and this undercut is then protected by a deposited passivation layer 21. As can be seen from FIG. 2 this arrangement produces a <u>rough sidewall</u> and as the etched steps increase, or indeed the aspect ratio increases, there can be bowing or re-entrant notching in the profile. The prior art documents describe the deposition of CF_x passivation layers. (emphasis added)

An inspection of Figure 2 and its enlargement, Figure 3 (column 2, lines 64 and 65), indicate the alternate etching and deposition referred to by Bhardwaj in column 4, lines 1-12, produced rough or jagged sidewalls schematically shown as having saw tooth variations. The scanning electron micrograms of Figures 10 and 11 proport to show the nature of the trenches formed by the prior art described in column 4. Figure 11 is an enlargement of

the mouth of the trench illustrated in Figure 10. Column 8, lines 19-26, indicate the structures shown by the scanning electron micrographs of Figures 10 and 11 are unacceptable for the majority of applications. While Figure 11 has a showing of a trench wall structure with portions that are rounded, there is nothing in Bhardwaj et al. to indicate the rounded portions of the trench wall are formed only by etching. The undercut that Bhardwaj et al. discuses in column 4, lines 3-11 is also never stated or shown to be rounded, as alleged in the Advisory Action.

It is not at all clear that etching alone forms any of the undesirable structures illustrated in Figures 2, 3, 10 or 11. In fact, the implication from Bhardwaj et al. is just the opposite. The undesirable structures illustrated in Figures 2, 3, 10 and 11 are formed by alternate deposition and etching. The scanning electron microgram of Figure 16 of the prior art to Bhardwaj et al. fails to include a rounded trench structure.

The Examiner's allegations concerning Bhardwaj et al. in the Advisory Action are incorrect. The Bhardwaj et al. process results from an imbalance between the deposition and etching steps that cause the undercut sidewalls shown in Figures 2 and 3. A main point of Bhardwaj et al. is to provide a balance between the separate deposition and etch steps as a function of the depth of a trench. By varying this balance as the trench becomes deeper during the etch process, Bhardwaj et al. attempts to obtain a balance between etching and depositing. To attempt to avoid the

undesirable undercut feature illustrated in Figures 2 and 3, Bhardwaj et al. indicates that the extent of the etching steps should be reduced relative to the extent of the deposition step during the first few alternate etching and deposition cycles. Figure 16 of the Bhardwaj et al. patent indicates the trench, as formed by the prior art of column 4, lines 1-12, is straight at the top and then tapers to a point at the bottom. The tapering occurs because the relative balance between the alternating etch and deposition steps has changed to favor deposition.

The discussion in column 5, lines 8-18, of Bhardwaj et al. also indicates feature formation in the Bhardwaj et al. alleged improvement is definitely not determined solely by etching. Column 5, lines 8-18, describes the complex balancing of etch and deposition characteristics in a series of steady state plasma experiments, where percent CH_4 in H_2 was varied. The focus is on how to select the different plasma parameters for each stage in the cyclic etch and deposition process. Much of the Bhardwaj et al. patent includes an extended discussion of the detailed interaction between the competing etch and deposition mechanisms. In each stage, the competing etch and deposition mechanisms interact with the spatial structures being formed. The importance of the cycle by cycle etch and deposition processes is discussed in column 6, lines 43-45 as well as column 7, lines 32-37, that indicates deposition is <u>increased</u> in the <u>first cycle</u> or first few cycles to overcome the undesirable undercut problem.

Appellants' claim 1 requires an AC etching plasma to be continuously applied to a workpiece while a feature of the workpiece is being formed and power applied to the plasma is gradually changed on a pre-programmed basis. Claim 17 is directed to a memory that stores a computer program for controlling a computer for controlling etching of a workpiece in a vacuum plasma processing chamber such that the computer program stores signals causing the continuous application of an AC etching plasma to a workpiece while a feature of the workpiece is being formed.

There is no disclosure in Bhardwaj et al. of forming a feature as a result of the continuous application of etchant. Instead, the Bhardwaj et al. feature, i.e., the trench and the trench wall are formed by alternate etching and deposition operations, as discussed *supra*. The undercut that Bhardwaj et al. indicates is an undesirable prior art structure certainly can not be considered a feature of the structure formed by Bhardwaj et al. The undercut is merely an undesirable part of the trench wall. Something that is undesirable can not be properly referred to as a feature.

The Advisory Action states that a "rounded trench structure" is formed by Bhardwaj et al. The Examiner provides no explanation as to what she means by the term "rounded trench structure." Bhardwaj et al. never uses such a term. If the Examiner refers to the curves in the wall illustrated in Figure 11 of Bhardwaj et al., there is no basis in the record to indicate that such a

rounded structure, which is undesirable because it results in a jagged surface, can be considered as a feature. Column 4, line 8, indicates the undercut produces a rough sidewall, which column 4, lines 12-15, of Bhardwaj et al. states is undesirable because it is not smooth.

Based on the foregoing, the rejection of claims 1 and 17 as being obvious as a result of Bhardwaj in view of Howald et al. is incorrect. The rejection is incorrect because the Examiner is wrong in saying Bhardwaj et al. discloses continuously applying AC etchant plasma to a workpiece while a feature of the workpiece is being formed.

Claims 2 and 18 distinguish over the combination of Bhardwaj et al. and Howald et al. by requiring the gradual change in power which is specified in claim 1 to occur while no change is made in the gas species that is converted into an AC etchant plasma, the vacuum chamber pressure or the flow rate of the gas specie. These limitations are not disclosed by Bhardwaj et al., despite the allegations by the Examiner. Bhardwaj et al. changes species to obtain alternate etching and deposition and changes pressure as power is changed; see column 6, lines 43-66, and column 9, lines 40-56, and column 9, line 65-column 10, line 3. The allegation in the Final Rejection that Bhardwaj et al. discloses forming a feature of a trench without changing flow rate and species is wrong. The portions of Bhardwaj et al. cited in the Final Rejection (the Abstract, column 6, lines 43-49, column 8, line 57-

column 9, line 26 and Figures 19(a) and 19(b)) together indicate the parameters of Claims 2 and 18, are varied.

Claim 8 requires the gradual power change of claim 1 as well as the species and the continuous application of plasma to the workpiece to be such that the material of the workpiece is shaped to have a rounded corner that includes the formed feature in response to changes in the ionized plasma etchant resulting from the gradual power change. Clearly, the prior art to Bhardwaj et al. does not have a rounded corner. In this regard, there are no rounded corners in the schematic showings of Figures 2 or 3, nor are there rounded corners in the scanning electron micrographs of Figures 10, 11 or 16. There are also no rounded corners shown in the scanning electron micrographs of Figures 12, 13 or 17. While the scanning electron micrograph in Figure 18 may have a showing of rounded corners at the bottom of the trench (and this is not clearly the case) there is nothing in Bhardwaj et al. to indicate that a rounded corner is formed by the continuous application of etchant plasma to the workpiece while a gradual change in the power applied to the plasma occurs, as claim 8 requires.

Claim 9 depends on claim 8 and further requires the etching, which occurs in response to changes in the ionized plasma etchant resulting from the gradual power change and the continuous application of the plasma to the workpiece, to form a trench wall. The trench wall includes the rounded corner resulting from the continuous etching. In all of the Bhardwaj et al. embodiments, as

well as the Bhardwaj et al. prior art, the trench wall is formed by alternate etching and deposition.

Claim 10 depends on claim 9 and requires the rounded corner to be at an intersection of a wall and a base of a trench. In Bhardwaj et al., there is no disclosure of corners as defined by claim 10 being formed by the continuous application of etching and gradual power changes. The inference from Bhardwaj et al. is just the opposite. As a trench is being formed in Bhardwaj et al., there are alternate deposition and etching steps. There is no indication in Bhardwaj et al. that anything special is done to form any of the corners.

Claim 11 depends on claim 8 and requires the rounded corner to be at an intersection of a wall and a surface intersecting the wall. The surface is required to extend generally at right angles to the wall. Such a rounded corner is required to be formed by the continuous etching, in combination with the gradual changes in the amount of AC power supplied to the plasma during etching. Again, there is nothing in Bhardwaj et al. to indicate any special attention is paid to forming rounded corners, particularly rounded corners at an intersection of a wall and a surface intersecting the wall, wherein the surface extends generally at right angles to the wall.

Claim 12 depends on claim 1 and requires the gradual power change of claim 1 to include steps having power changes no greater

than about several watts. The power is required to remain at a constant wattage for no more than about 1 second. Claim 26 includes a similar limitation and further requires the power change to be substantially continuous. Claims 27, 28, 30 and 31 include similar limitations. Claim 13 depends on claim 12 and further requires the power steps to be of a few milliwatts and remain at a constant power for about 1 millisecond.

Appellants achieve very precise control by using these durations and do not need to resort to cumbersome alternate deposition and etching steps as Bhardwaj et al. employs and which have the disadvantages set forth in appellants' application as filed, i.e., the time required to purge the gas lines increases the workpiece processing time and imprecise control of processing of workpieces. Page 13, lines 15 and 16, of the application states: "Steps longer than one second will not usually provide the desired rounding effect." Hence, the time and wattage limitations of claims 12, 13, 26-28, 30 and 31 are not a mere matter of design as alleged in the final rejection.

In contrast to the steps Appellants employ, Bhardwaj et al. indicates the steps have durations between 2 and 15 seconds and that 4-6 seconds are preferred; see column 6, lines 53, 54 and 61. The minimum Bhardwaj et al. duration is more than 3 orders of magnitude greater than the 1 millisecond duration of claim 13. Such a difference is not a matter of design, but is a significant difference in kind. Bhardwaj et al. does not change power in such

small steps because the power changes generally are accompanied by changes between deposition and etching. During etching and deposition, different gases flow into the chamber. Such changes in gas flow can not occur during one millisecond.

Claim 20 depends on claim 17 and indicates the stored signals control (1) etchant species supplied to the workpiece while the workpiece is being processed and (2) the gradual power transition so as to cause the workpiece to be etched to have a rounded corner. The rounded corner is required, by claim 17, to result from continuous application of etchant. In Bhardwaj et al. there is no indication of a rounded corner being formed as a result of a gradual power transition and the application of continuous etching.

Claim 21 requires the memory of claim 20 to be such that the stored signals control etchant species supplied to the chamber while the workpiece is being processed. The stored signals also control gradual power transitions so as to cause the workpiece to be etched to have a trench wall including the rounded corner. As discussed previously, the rounded corner feature is not discussed in any way by Bhardwaj et al. Further, Bhardwaj et al. has no disclosure of such rounded corners being formed by the continuous application of etchant while the power supply to the plasma is being varied.

The Howald et al. reference does not cure any of the foregoing deficiencies of Bhardwaj et al. The Examiner makes no arguments in connection with regard to Howald et al. disclosing such features.

IX. Conclusion

Independent claims 1 and 17 distinguish over the applied references by requiring the continuous application of an AC etchant plasma to a workpiece while a feature is being formed, in combination with the gradual changing, on a pre-programmed basis, of the amount of AC power supplied to the plasma during etching of the workpiece. A gradual transition in the shape of the material in the workpiece being processed occurs in response to the gradual power change that occurs during the gradual transition in the shape of the material. By using these steps, trench walls and rounded corners are required to be formed in dependent claims 8-11, 20-22. In Bhardwaj et al., features are formed by alternate deposition and etching, rather than by the continuous application of AC etchant plasma to a workpiece while a feature is being formed. There is no discussion whatsoever in Bhardwaj et al. of forming corners, no less forming corners as defined by Appellants' dependent claims. Further, the trench wall in Bhardwaj et al. is formed only by alternate etching and deposition.

Dependent claims 2 and 18 require the gradual change in the amount of power applied to the AC etchant plasma to occur while

no change is made in the species of the gas, the chamber pressure or the flow rate. Bhardwaj et al. discloses changing the species, pressure and/or flow rate while a trench wall is formed. Alternate etching and deposition require different species.

Appellants obtain precise control by having power changes no greater than about several watts, wherein the power remains at a constant wattage for no more than about 1 second. Preferably, the power steps are a few milliwatts and remain at a constant power for about 1 millisecond. None of the foregoing limitations on the amount and duration of the power are disclosed by Bhardwaj et al. and are opposite from the 2-15 second duration Bhardwaj et al. discloses; Bhardwaj et al. indicates the preferred duration of the steps is 4-6 seconds. In Bhardwaj et al., such durations are necessary because the power is varied in synchronism with the opening and closing of valves associated with the flow of different gases (the etchant and deposition gases) into the chamber, as illustrated by the waveforms of Figures 6 and 7.

Based on the foregoing, claims 1-6, 8-13, 17, 18, 20-23, 25, 26, 28, 30, and 31 are allowable, and the rejection thereof cannot be sustained.

Respectfully submitted,

LOWE HAUPTMAN & BERNER, LLP

By: Allan M. Lowe

Allan M. Lowe
Reg. No. 19,641

Customer No. 22429
1700 Diagonal Road, Suite 300
Alexandria, VA 22314
703-684-1111 Telephone
703-518-5499 Telecopier
AML:tal

VIII. Claims Appendix

Claim 1: A method of etching a workpiece in a vacuum plasma processor chamber comprising converting a gas species into an AC etchant plasma that is continuously applied to the workpiece while a feature of the workpiece is being formed, the vacuum chamber being subject to operating at different pressures while the workpiece is being processed, the gas species being subject to flowing into the chamber at different flow rates while the workpiece is being processed, gradually changing, on a pre-programmed basis, the amount of AC power supplied to the plasma during etching of the workpiece, wherein a gradual transition in the shape of material in the workpiece being processed occurs in response to the gradual power change, the gradual power change occurring during the gradual transition in the shape of the material.

Claim 2: The method of claim 1 wherein the gradual power change occurs while no change is made in (a) the species, (b) the pressure or (c) the flow rate.

Claim 3: The method of claim 1 wherein the AC power is supplied by an electrode coupling an AC electric field to plasma in the chamber.

Claim 4: The method of claim 3 wherein the electrode is responsive to an AC power source that supplies RF bias voltage to the electrode, the electrode being on a holder for the workpiece.

Claim 5: The method of claim 3 wherein the electrode is responsive to an AC power source that supplies RF plasma excitation voltage to the electrode, the electrode responding to the RF voltage to supply RF electric field to the plasma to excite the gas to the plasma.

Claim 6: The method of claim 3 wherein the AC power is supplied by a coil coupling an RF plasma excitation electromagnetic field to the chamber.

Claim 8: The method of claim 1 wherein the species is ionized into a plasma that etches the material to form the feature, the gradual power change, the species and the continuous application of the plasma to the workpiece being such that the material is shaped to have a rounded corner that includes the formed feature in response to changes in the ionized plasma etchant resulting from the gradual power change

Claim 9: The method of claim 8 wherein the etching, which occurs in response to changes in the ionized plasma etchant resulting from the gradual power change and the continuous application of the plasma to the workpiece, forms a trench wall

including the rounded corner, the trench and the rounded corner being included in the formed features.

Claim 10: The method of claim 9 wherein the rounded corner is at an intersection of a wall and a base of a trench

Claim 11: The method of claim 8 wherein the rounded corner is at an intersection of a wall and a surface intersecting the wall, the surface extending generally at right angles to the wall.

Claim 12: The method of claim 1 wherein the gradual change includes steps having power changes no greater than about several watts, the power remaining at a constant wattage for no more than about 1 second.

Claim 13: The method of claim 12 wherein the power steps are a few milliwatts and remain at a constant power for about 1 millisecond.

Claim 17: A memory storing a computer program for controlling a computer for controlling etching of a workpiece in a vacuum plasma processor chamber wherein a gas species is converted into an AC etchant plasma, the chamber being capable of operating at different pressures while the workpiece is being processed, the gas species being subject to flowing into the

chamber at different flow rates while the workpiece is being processed, the computer program storing signals causing (a) control of the amount of AC power applied to the plasma while the workpiece is being etched; and (b) the continuous application of the AC etchant plasma to the workpiece while a feature of the workpiece is being formed, the stored signal for controlling the amount of applied AC power causing gradual preprogrammed changes in the amount of AC power supplied to the etchant plasma during etching of the workpiece, the stored signal causing gradual power change being such as to cause a gradual transition in the shape of material in the workpiece being etched in response to the gradual power change to cause the gradual power change to occur during the gradual transition in the shape of the material.

Claim 18: The memory of claim 17 wherein the computer program also stores signals causing (a) the vacuum chamber to operate at different pressures while the workpiece is being etched and (b) control of the gas species type and the flow rates thereof into the chamber while the workpiece is being etched, the stored signals causing the gradual power change to occur while no change is made in (a) the species, (b) the pressure or (c) the flow rate

Claim 20: The memory of claim 17 wherein the stored signals control etchant species supplied to the chamber while the

workpiece is being processed and the gradual power transition so as to cause the workpiece to be etched to have a rounded corner.

Claim 21: The memory of claim 20 wherein the stored signals control etchant species supplied to the chamber while the workpiece is being processed and the gradual power transition so as to cause the workpiece to be etched to have a trench wall including the rounded corner.

Claim 22: The memory of claim 21 wherein the rounded corner is at an intersection of a wall and a base of a trench.

Claim 23: The method of claim 1 wherein the gradual change is substantially continuous and gradual.

Claim 25: The memory of claim 17 wherein the gradual change is substantially continuous and gradual.

Claim 26: The method of claim 23 wherein the gradual change includes steps having power changes in the range of a few milliwatts to several watts and having durations in the range of about one millisecond to no more than one second.

Claim 28: The memory of claim 17 wherein the gradual change includes steps having power changes in the

range of a few milliwatts to several watts and having durations in the range of about one millisecond to no more than one second.

Claim 30: The method of claim 8 wherein the gradual change includes steps having power changes no greater than about several watts, the power remaining at a constant wattage for no more than about 1 second.

Claim 31: The memory of claim 20 wherein the gradual change includes steps having power changes in the range of a few milliwatts to several watts and having durations in the range of about one millisecond to no more than one second.